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मानक

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IS 3990 (1967): High Temperature Ceramic Combustion Tubes
[CHD 10: Glassware]



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“Knowledge is such a treasure which cannot be stolen”

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IS : 3990 - 1967
Reaffirmed - 2012

Indian Standard

SPECIFICATION FOR COMBUSTION TUBES

(First Reprint DECEMBER 1981)

UDC 542.42 : 662.9.042



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

MAY 1967

AMENDMENT NO. 2 OCTOBER 1976
TO
IS : 3990-1967 SPECIFICATION FOR
COMBUSTION TUBES

Alteration

*(First cover page and pages 1 and 3,
Title)* - Substitute the following for the
existing title at all the places:

**'SPECIFICATION FOR HIGH TEMPERATURE
CERAMIC COMBUSTION TUBES'**

(CDC 27)

Reprography Unit, ISI, New Delhi

AMENDMENT NO. 1 SEPTEMBER 1967
TO
IS : 3990-1967 SPECIFICATION FOR COMBUSTION
TUBES

Corrigenda

(*Page 7, clause **B-2.1**, line 3*) — Substitute 'and leakage of gas' for 'thermal shock and warpage'.

(*Page 8, clause **B-2.3**, last but one line*) — Substitute 0.5 percent' for '5 percent'.

Indian Standard

SPECIFICATION FOR COMBUSTION TUBES

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Indian Standard

SPECIFICATION FOR COMBUSTION TUBES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 1 February 1967, after the draft finalized by the Ceramicware Sectional Committee had been approved by the Chemical Division Council.

0.2 Combustion tubes having dense homogeneous body, characterized by mechanical and thermal resistance are used in tube furnaces for quantitative estimation in general laboratory work, such as estimation of carbon and sulphur in steel. It is hoped that this standard will help consumers in selecting a suitable quality of tubes and will also guide the manufacturers in meeting the requirements demanded by the consumers.

0.3 In the formulation of this standard valuable assistance has been rendered by the Central Glass and Ceramic Research Institute (CSIR), Calcutta.

0.4 This standard contains clauses 3.3.1, 3.3.2 and 4.1 which permit the purchaser to use his option for selection to suit his requirements.

0.5 This standard is one of series of Indian Standards for laboratory porcelain. Other standards published so far in this series are:

IS : 2836-1964 Methods of test for laboratory porcelain

IS : 2837-1964 Specification for porcelain crucibles and basins

IS : 3482-1965 Specification for clay pipe triangles

IS : 3936-1966 Specification for porcelain mortars and pestles

IS : 3953-1966 Specification for high temperature combustion boats

0.6 For the purpose of deciding whether a particular requirements of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off values should be the same as that of the specified values in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for combustion tubes used in general laboratory analysis.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 2781-1964* shall apply.

3. REQUIREMENTS

3.1 Material and Manufacture — The tube shall be made of clay, kyanite, sillimanite, zirconia or alumina or any other material having suitable chemical and thermal properties. It shall be impervious and homogeneous in nature and shall have good mechanical properties.

3.1.1 The tube shall be as straight as possible and shall not warp during using.

3.1.2 It shall have good thermal-stock resistance.

3.1.3 The tubes shall not soften at the temperature of operation and shall have a fusion point of about 1600°C.

3.2 Porosity — The water absorption shall be not more than 0.5 percent when tested in accordance with the method prescribed in Appendix A.

3.3 Dimensions — The tubes shall conform to the dimensions given below:

<i>Sl No.</i>	<i>Outside m m</i>	<i>Diameter</i>	<i>Inside Diameter mm</i>	<i>Length mm</i>
i)	22 ± 1		17 ± 1	610
ii)	25 ± 1		20 ± 1	610
iii)	28 ± 1		22 ± 1	610
iv)	30 ± 1		25 ± 1	610

3.3.1 Combustion tubes of 500 or 750 mm length may also be specified subject to the agreement between the purchaser and the supplier.

3.3.2 Any special shape such as tapered end shall be subject to the agreement between the purchaser and the supplier.

4. PACKING AND MARKING

4.1 The tubes shall be suitably packed as agreed to between the purchaser and the supplier.

*Glossary of terms relating to ceramicware.

4.2 The tubes or the label attached to the package shall be clearly marked with the name of the manufacturer or his trade-mark, if any.

4.2.1 The package may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5. SAMPLING

5.1 Representative samples of the tubes shall be drawn and their criteria for conformity shall be determined in accordance with the method prescribed in Appendix B.

6. TEST METHODS

6.1 Test for Leakage of Gas — Take at least 3 tubes of any size for the test for leakage of gases through the wall of the tube. Close one end of the tube by means of a rubber tubing and pinch-cock and connect the other end to a vacuum pumps with a monometer between the tube and the pump. Immerse the tube completely in water and start the vacuum pump. Create a negative pressure of 600 mm Hg. Release the vacuum, take the tube out and examine for any water inside the tube.

6.1.1 Under a vacuum of 600 mm Hg, no water shall enter the test tube.

A P P E N D I X A

(Clause 3.2)

TEST FOR POROSITY

A-0. PRINCIPLE

A-0.1 Porosity is determined from the amount of water absorbed by the combustion tubes. The tubes are evacuated in distilled water, when on releasing the vacuum, water occupies the pores.

A-1. TEST PIECES

A-1.1 Cut or break five pieces from the whole tube. The test pieces shall be of such length as to facilitate their immersion in water in the testing vessel.

A-2. Procedure

A-2.1 Dry the test pieces to a constant weight at a temperature between 110° and 115°C, and then cool to room temperature in a desiccator. Weigh the pieces to an accuracy of 0.01 g, and place in a vessel (from which the air can be removed) maintaining the pressure at less than 30 mm Hg for one hour. Admit cold freshly boiled distilled water to the vessel without reducing the vacuum until the pieces are covered fully. Then release the vacuum. Keep the test pieces immersed under distilled water for an hour and then remove them. Wipe the pieces with smooth damp cloth in such a manner as to remove the surface water only and then weigh.

A-3. CALCULATION

A-3.1 Water absorbed, percent by weight = $\frac{100 (W_2 - W_1)}{W_1}$

where

W_2 = weight of the soaked test, piece, and
 W_1 = weight of the dry test piece

A-4. REPORT

A-4.1 Determine the percentage water absorbed by each of the five test pieces and report the average of them.

APPENDIX B

(Clause 5.1)

SAMPLING OF COMBUSTION TUBES

B-1. SCALE OF SAMPLING

B-1.1 Lot — All the combustion tubes of the same dimensions produced under essentially similar conditions of manufacture and offered for inspection at the same time shall be regarded as constituting a lot.

B-1.2 The conformity of the lot to the requirements of this specification shall be ascertained separately for each lot. The number of articles to

be selected for this purpose shall depend on the size of the lot and shall be in accordance with col 1 and 2 of Table 1.

TABLE 1 NUMBER OF SAMPLES

(Clause B-1.2)

No. OF ARTICLES IN THE LOT	No, OF ARTICLES TO BE SELECT- ED IN THE SAMPLE	PERMISSIBLE No. OF DE- FECTIVES FOR REQUIRE- MENTS OTHER THAN 3.2 AND 6.1	NO. TO BE TESTED FOR 6.1	PERMIS- SIBLE No. OF FAILUR- ES IN 6.1	No. TO BE TEST- ED FOR 3.2
(1)	(2)	(3)	(4)	(5)	(6)
Up to 100	12	1	3	0	3
101 „ 500	20		5	0	4
501 „ 3 000	32	3	8	1	5
3 001 „ 5 000	50	5	13		6
5 001 and over	80	7	20	3	7

B-1.3 The samples shall be selected at random from the lot. To ensure randomness of selection use shall be made of random number tables. If random number tables are not available the following procedure shall be adopted:

Starting from any article in the lot count them in one order as 1, 2, 3 ..., etc, up to r and so on where r is the integral part of N/n (N being the number of articles in the lot and n the number of articles in the sample). Every r th article thus counted shall be withdrawn to constitute the sample.

B-1.3.1 In case the articles in a lot are offered in packages or cases the first stage in sampling shall be to select at random at least 20 percent of packages or cases. In the second stage from each of the selected cases or packages equal number of articles shall be selected at random so as to make up the number required in col 2 of Table 1. The randomness of selection in both the stages may be ensured by following the procedure of **B-1.3**.

B-2. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-2.1 All the articles sampled from the lot in accordance with **B-1.2** and **B-1.3** shall be examined for all requirements other than porosity, thermal shock and warpage. Any article failing in any one or more of the requirements examined shall be termed as defective. If the number

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of defectives found in the sample does not exceed the corresponding number given in col 3 of Table 1, the lot shall be considered to satisfy the requirements examined and tested further, otherwise the lot shall be rejected without further testing.

B-2.2 The lot having been declared satisfactory in **B-2.1**, it shall next be tested for leakage of gas (*see 6.1*). The number of articles to be subjected to leakage test as described in **6.1**, shall be in accordance with col 4 of Table 1 and they shall be picked up at random from the non-defective part of the sample in **B-2.1**. If the number of articles failing the test does not exceed the corresponding number given in col 5 of Table 1, the lot shall be considered to satisfy the leakage test and tested further, otherwise the lot shall be rejected without further testing.

B-2.3 The lot having been declared satisfactory in **B-2.1** in respect of leakage it shall next be tested for porosity (*see 3.2*). The number of articles for this purpose shall be in accordance with col 6 of Table 1 and they shall be picked up at random from the non-defective part of the sample in **B-2.1**. For each selected article water absorption shall be determined by the method described in Appendix A. From the test results of water absorption, the average (\bar{x}) and range (R) of the test results shall be computed (range being the difference between the maximum and the minimum values of the test results).

The lot shall be declared as conforming to the requirements of this specification if the value of the expression $(\bar{x} + 0.6 R)$ calculated from the test results is equal to or less than 5 percent, the value specified in **3.2**.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous Intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Conversion</i>
Force	newton	N	1 N = 1 kg.1 m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	slemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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